

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/309568313>

# Surgical Outcome after Penile Inversion Vaginoplasty: A Retrospective Study of 475 Transgender Women

Article in Plastic & Reconstructive Surgery · November 2016

DOI 10.1097/PRS.0000000000002684

CITATIONS  
140

READS  
125,428

8 authors, including:

 Marlon E Buncamper  
Amsterdam University Medical Center  
56 PUBLICATIONS 1,832 CITATIONS

[SEE PROFILE](#)

 Wouter Van der Sluis  
Amsterdam University Medical Center  
85 PUBLICATIONS 1,588 CITATIONS

[SEE PROFILE](#)

 Mujde Ozer  
Amsterdam University Medical Center  
47 PUBLICATIONS 1,455 CITATIONS

[SEE PROFILE](#)

 Jan Maerten Smit  
Amsterdam University Medical Center  
39 PUBLICATIONS 1,588 CITATIONS

[SEE PROFILE](#)



# Surgical Outcome after Penile Inversion Vaginoplasty: A Retrospective Study of 475 Transgender Women

Marlon E. Buncamper,  
M.D., Ph.D.

Wouter B. van der Sluis,  
M.D., Ph.D.

Roos S. D. van der Pas, M.D.  
Müjde Özer, M.D.

Jan Maerten Smit, M.D.  
Birgit I. Witte, Ph.D.

Mark-Bram Bouman,  
M.D., Ph.D.

Margriet G. Mullender, Ph.D.  
Amsterdam, The Netherlands



**Background:** For many transgender women, vaginoplasty is the final stage in the gender-confirming process. Penile inversion vaginoplasty is considered the gold standard for vaginal construction in transgender women. In this study, the authors assessed intraoperative and postoperative complications after penile inversion vaginoplasty.

**Methods:** All patients who underwent penile inversion vaginoplasty between January of 2000 and January of 2014 were identified retrospectively from the authors' hospital registry. A retrospective chart review was conducted. Outcome measures were intraoperative and postoperative complications, reoperations, secondary surgical procedures, and possible risk factors.

**Results:** Between January of 2000 and January of 2014, 475 patients underwent penile inversion vaginoplasty, 405 of whom did not have and 70 of whom did have additional full-thickness skin grafts. The median patient age at surgery was 38.6 years (range, 18.1 to 70.8 years). Median follow-up was 7.8 years (range, 1.0 to 15.9 years). The most frequently observed intraoperative complication was rectal injury [ $n = 11$  (2.3 percent)]. Short-term postoperative bleeding that required transfusion [ $n = 23$  (4.8 percent)], reoperation [ $n = 7$  (1.5 percent)] or both [ $n = 2$  (0.4 percent)] occurred in some cases. Major complications comprised three (0.6 percent) rectoneovaginal fistulas, which were successfully treated. Revision vaginoplasty was performed in 14 patients (2.9 percent). Comorbid diabetes was associated with a higher risk of local infection (OR, 9.8;  $p = 0.003$ ; 95 percent CI, 2.8 to 34.4), and use of psychotropic medication predisposed to postoperative urinary retention (OR, 2.1;  $p = 0.006$ ; 95 percent CI, 1.2 to 3.5).

**Conclusions:** Successful vaginal construction without the need for secondary functional reoperations was achieved in the majority of patients. Intraoperative complications are scarce. Postoperative complications occur frequently but are generally minor and easily treated. (*Plast. Reconstr. Surg.* 138: 999, 2016.)

**CLINICAL QUESTION/LEVEL OF EVIDENCE:** Therapeutic, IV.

**V**aginoplasty, the surgical construction of a vagina, is indicated as genital reassignment surgery for transgender women. For many transgender women, vaginoplasty is the final stage in the gender-confirming process.<sup>1</sup> Vaginoplasty has a positive impact on the (sexual) quality of

life of these women.<sup>2-6</sup> The goal is to create a feminine vulva, a deep and wide enough vaginal cavity to facilitate neovaginal penetration, a hooded

**Disclosure:** The authors have no financial interest to declare in relation to the content of this article.

Supplemental digital content is available for this article. Direct URL citations appear in the text; simply type the URL address into any Web browser to access this content. Clickable links to the material are provided in the HTML text of this article on the Journal's website ([www.PRSJournal.com](http://www.PRSJournal.com)).

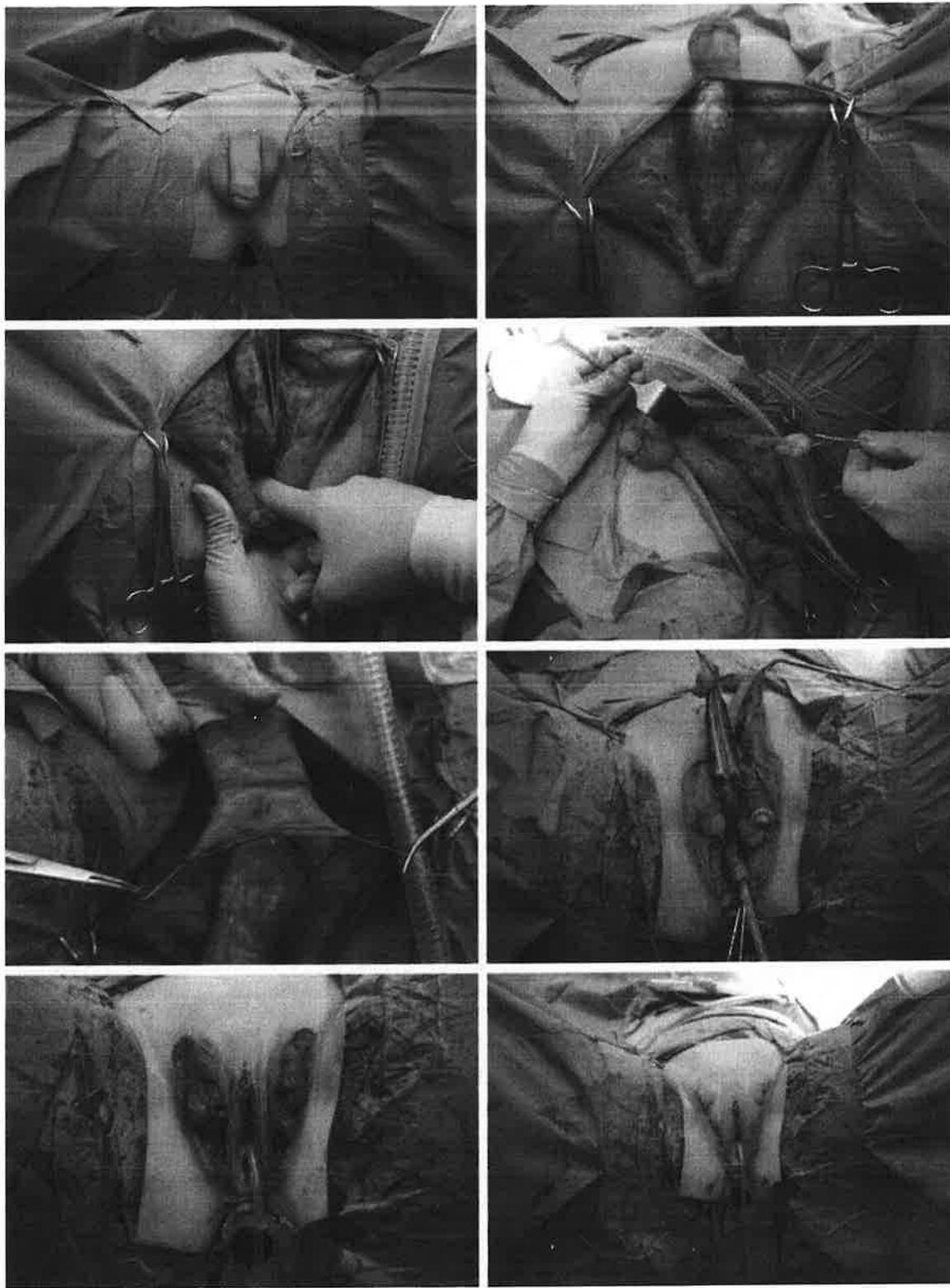
From the Department of Plastic, Reconstructive, and Hand Surgery, the Center of Expertise on Gender Dysphoria, the EMGO+ Institute for Health and Care Research, and the Department of Epidemiology and Biostatistics, VU University Medical Center, and Gender Surgery Amsterdam.

Received for publication January 21, 2016; accepted June 17, 2016.

The first two authors contributed equally to this article.

Copyright © 2016 by the American Society of Plastic Surgeons

DOI: 10.1097/PRS.0000000000002684



**Fig. 1.** Penile inversion vaginoplasty performed in a 51-year-old transgender woman. (Above, left) Preoperative photograph of the genital area. (Above, right) An incision is made along the preoperatively marked pattern. (Second row, left) Blunt dissection of the neovaginal cavity is performed. Caution is taken not to sever the rectum. This is regularly checked by bimanual palpation. (Second row, right) Bilateral orchiectomy is performed. (Third row, left) The penile skin is separated from the penile shaft and closed at the distal end. (Third row, right) The dorsal neurovascular bundle is separated from the roof of the corpora cavernosa, and from a part of the glans penis and preputium. (Continued)

sensate clitoris, and labia minora with the fewest possible surgical complications.<sup>7</sup> Penile inversion vaginoplasty is the most frequently performed procedure for vaginal construction in transgender women.<sup>8-10</sup> These patients report high satisfaction with both the functional and aesthetic results.<sup>8</sup> Although other surgical techniques exist (e.g., nongenital skin flap vaginoplasty, intestinal vaginoplasty, and peritoneal vaginoplasty), because of its advantages in producing a lined vaginal cavity that shrinks little and is non-hair-bearing and sensate, penile inversion vaginoplasty is still considered the surgical gold standard.<sup>9,10</sup> A full-thickness skin graft can be added to provide extra depth of the neovagina, when penile skin alone is insufficient. The aim of this study was to review our surgical technique and assess intraoperative and postoperative complications after penile inversion vaginoplasty and identify predictors for postoperative complications.

## PATIENTS AND METHODS

### Study Design

All transgender women who underwent penile inversion vaginoplasty between January of 2000 and January of 2014 at the VU University Medical Center were retrospectively identified from our hospital registry. A retrospective chart review was conducted recording patient demographics, intraoperative and postoperative complications, reoperations, and secondary surgical procedures. Recorded patient demographics comprised age at surgery, weight, length, body mass index, intoxications, somatic and mental medical history, and the use of medication. Recorded surgical data comprised date of surgery, performing surgeon, surgical technique (penile inversion with or without full-thickness skin graft), and operative duration. Furthermore, the length of hospitalization, intraoperative and postoperative complications, reoperations, and secondary surgical procedures were noted. Complications were categorized into three categories:

1. Intraoperative complications, subdivided into rectal or urethral lesions and bleeding needing transfusion.
2. Short-term postoperative complications, subdivided into infection, bleeding, any type of

**Fig. 1. Continued.** the neoclitoris and the labia minora are sculptured. (Below, left) A linear incision is made into the raphe of the penile skin, and the penoscrotal flap is imbedded. (Below, right) Postoperative photograph of the genital area.

vaginal or vulvar necrosis, rectovaginal fistulas, and urinary complications (e.g., urinary retention and urinary tract infections).

3. Long-term postoperative complications, subdivided into stenosis, urinary complications, urethrovaginal fistulas, and prolapse.

### Patient Selection and Surgical Eligibility

All subjects were older than 18 years of age and had passed the real-life experience, in which a patient is expected to live for at least 1 year in the gender role consistent with her gender identity. Patients were deemed medically and psychologically fit by the multidisciplinary gender team of our institution (plastic surgeon, urologist, psychologist, endocrinologist, psychiatrist, and gynecologist). They were deemed eligible for surgery if their body mass index was less than 30 kg/m<sup>2</sup> and if they had refrained from smoking more than 6 weeks before surgery (urine tests were taken at random). For each patient, psychological eligibility was assessed by qualified psychologists, appropriately trained in mental health and experienced in the assessment of gender dysphoria, through multiple counseling sessions, according to the Standards of Care for the Health of Transsexual, Transgender, and Gender Nonconforming People.<sup>1</sup> Hormonal therapy was stopped 6 weeks before surgery. If the penile skin was between 7 and 12 cm, an additional full-thickness skin graft was used if there was a wish from the patient to achieve more vaginal depth.

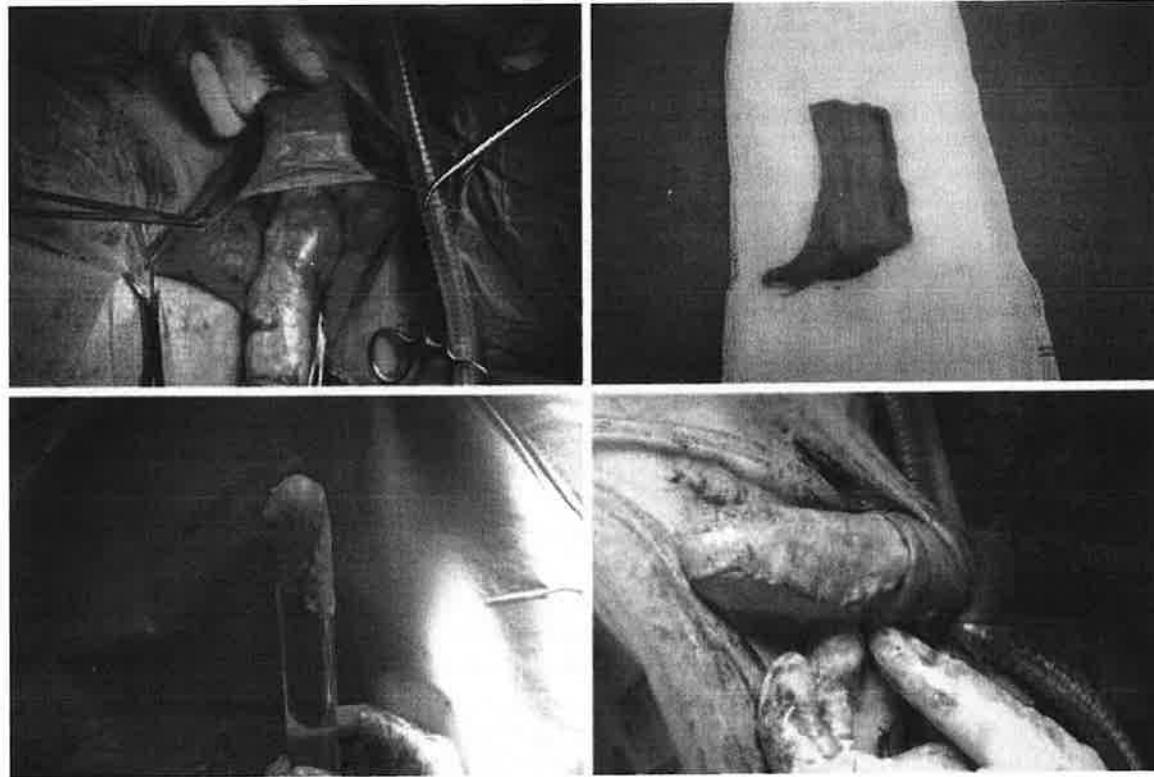
### Surgical Technique

One day before surgery, patients are admitted for bowel preparation with a Microlax (Johnson & Johnson, New Brunswick, N.J.) enema. At the start of surgery, patients are given antibiotic prophylaxis intravenously (cefuroxime 1500 mg and metronidazole 500 mg). The patient is placed in lithotomy position and the surgical area is disinfected (Fig. 1, *above, left*). The penoscrotal flap is marked until 1 cm from the anus with dimensions of approximately 2 cm in width and 8 cm in length depending on the size of the penis, and the base of the penis and the midline on the ventral side of the penis. The operative area is infiltrated with lidocaine/adrenalin, and an incision is made along the marked pattern (Fig. 1, *above, right*). After separation of the penoscrotal flap from the bulbospongiosus muscle, a transurethral catheter of 18 to 20 French is inserted in the urethra and a tampon is inserted in the anus. The urogenital diaphragm is opened in the midline and the

levator ani muscle is incised to the left and right to create enough width for the neovagina. This provides access to the Denonvilliers space, which is dissected bluntly, taking care not to sever the urethra and rectum (Fig. 1, *second row, left*).

The tunica dartos is opened in the midline and an orchietomy is performed (Fig. 1, *second row, right*). A circumcision is performed at the preputial base. The penile skin and the urethra are separated from the corpora cavernosa (Fig. 1, *third row, left*). The dorsal neurovascular bundle is separated from the roof of the corpora cavernosa, leaving the glans penis and preputium vascularized (Fig. 1, *third row, right*). From a part of the glans penis and preputium, the neoclitoris and the labia minora are sculptured. The corpora cavernosa are dissected to their base and resected at the level of the crura and sutured together, providing an elevation on which to place the neoclitoris. Guided by the transurethral catheter, a subtotal resection of the corpus spongiosum is performed and the remains are sutured together for hemostatic reasons. At the mons veneris, the subcutis is dissected off the periost, and the neurovascular bundle is positioned on

the periost. The clitoris is positioned on the elevation. The shortened urethra is sutured into place just caudally of the clitoris. A longitudinal incision is made into the dorsal side of the penile skin, to bring the clitoris and urethra outward. Supportive stitches are placed at the corpora cavernosa to further define the anterior commissure. A linear incision is made into the raphe of the penile skin and the penoscrotal flap is imbedded (Fig. 1, *below, left*). If the amount of penile skin is deemed insufficient by the surgeon and if the patient preoperatively expresses the wish for a deeper vagina, a full-thickness skin graft is used to deepen the neovagina (Fig. 2). This is taken from either the excessive scrotal skin, skin of the groin area, or the lower abdomen. Most full-thickness skin grafts are taken from the excess scrotal skin. Two suction drains are positioned medially onto the perineum. Subsequently, the penoscrotal skin is inserted. Excessive scrotal skin is excised to define the labia majora. The skin is sutured, placing the scars in the groin area. A gauze-filled double condom is placed into the neovagina and fixed with translabial sutures. Over the years, there were no major changes in



**Fig. 2.** Addition of scrotal full-thickness skin graft to penile inversion vaginoplasty. (Above, left) The inverted penile flap is not closed, facilitating full-thickness skin graft placement in the neovaginal top. (Above, right) A scrotal full-thickness skin graft is taken. (Below, left) The full-thickness skin graft is placed on a Perspex (Preecha Aesthetic Institute, Bangkok, Thailand) dildo. (Below, right) The full-thickness skin graft is sutured to the distal end of the inverted flap and subsequently placed in the neovaginal cavity.

**Table 1. Patient Demographics**

	Total (%)	Penile-Inversion Vaginoplasty without Additional FTG (%)	Penile-Inversion Vaginoplasty with Additional FTG (%)	<i>p</i>
No.	475	405	70	
Age, yr				0.70*
Median	38.6	38.6	38.4	
Range	18.1–70.8	18.1–70.8	18.4–59.2	
Mean BMI $\pm$ SD, kg/m <sup>2</sup>	23.7 $\pm$ 3.1	23.8 $\pm$ 3.2	23.6 $\pm$ 2.7	0.62†
Cardiovascular comorbidity	59 (12.4)	52 (12.8)	7 (10.0)	0.51‡
Use of anticoagulants	15 (3.2)	14 (3.5)	1 (1.4)	0.37‡
Diabetes	14 (2.9)	13 (3.2)	1 (2.4)	0.66‡
HIV-positive	14 (2.9)	10 (2.5)	4 (5.7)	0.14‡

FTG, full-thickness skin graft; BMI, body mass index; HIV, human immunodeficiency virus.

\*Mann-Whitney *U* test.

†Independent samples *t* test.

‡ $\chi^2$  test.

operative technique, just small refinements in the creation of the labia minora and majora and placement of the neoclitoris.

### Postoperative Care

Patients receive additional prophylactic antibiotics (cefuroxime and metronidazole) 8 and 16 hours postoperatively and thromboembolic prophylaxis. From 2000 to 2012, ambulation would start at the fifth postoperative day. From 2012, ambulation started at the second postoperative day. On the fifth postoperative day, the tampon and transurethral catheter are removed and the wounds inspected. After removal of the transurethral catheter, spontaneous voiding is observed and checked with a bladder scan to determine whether there is bladder residue. Cotrimoxazole is given as antibiotic prophylaxis for urinary tract infection for 5 days. Patients are given instructions on how to dilate and rinse their neovagina, after which they are discharged from the hospital. They are given the instruction to dilate twice daily for 30 minutes for the first postoperative year and also rinse the vagina with povidone-iodine solution twice daily for the first 3 months. Scheduled outpatient clinic visits are set at 2 and 5 weeks, 3 and 6 months, and 1 and 2 years after surgery for follow-up. When patients are ambulant again, they can restart their cross-sex hormones.

### Statistical Analysis

Statistical analyses were performed with IBM SPSS Version 20 for Windows (IBM Corp., Armonk, N.Y.). Values of *p* < 0.05 were considered significant. Categorical variables are described by frequency and percentage. Gaussian continuous variables were compared using the independent samples *t* test, non-Gaussian continuous variables

were compared using the Mann-Whitney *U* test, and categorical variables were compared using the chi-square test. Univariate analysis of preoperative risk factors and postoperative complications was performed, and odds ratios with 95 percent confidence intervals were reported. This retrospective chart study was exempt from institutional review board approval. All photographed patients provided written informed consent.

## RESULTS

### Demographics

Between January of 2000 and January of 2014, a total of 475 patients underwent penile inversion vaginoplasty at our institution. Of those 475 patients, 405 (85.3 percent) were performed without and 70 (14.7 percent) with the use of additional full-thickness skin grafting. Patient demographics are listed in Table 1, subdivided by surgical technique. Of a total of 475 patients, 84 (17.7 percent) had a history of smoking and 28 (5.9 percent) had a history of drug use. Median follow-up was 7.8 years (range, 1.0 to 15.9 years). The surgical procedures were performed by seven separate staff members, mostly assisted by residents.

### Operative Characteristics and Intraoperative Complications

The median operative duration was 213 minutes (range, 109 to 330 minutes). (See Figure, Supplemental Digital Content 1, which shows the box plot representation of operative duration per year, <http://links.lww.com/PRS/B889>.) Additional full-thickness skin grafts, used predominantly after January of 2010, led to a prolonged intraoperative time [median, 216 minutes (range, 133 to 330 minutes) versus 200 minutes (range, 109 to 300

minutes);  $p = 0.037$ ). Intraoperative complications are listed in Table 2. There was no intraoperative mortality. Intraoperative bleeding that required postoperative transfusion occurred in 23 patients (4.8 percent). Rectal injuries, which occurred in 11 patients (2.3 percent), were all sutured primarily. In one of these patients, a rectoneovaginal fistula became manifest, which was resolved later by fistulectomy and local transposition. In five patients (1.1 percent), urethral lacerations occurred, which were oversewn intraoperatively.

### Short-Term Postoperative Complications and Hospitalization

An overview of short-term postoperative complications is presented in Table 2. There was no postoperative mortality. Major complications comprised three rectoneovaginal fistulas (0.6 percent), which were successfully treated with fistulectomy and local transposition under general anesthesia in two patients and conservatively in

one patient. In 66 patients (13.9 percent), urinary retention occurred after removal of the transurethral catheter. This was treated by either temporary (re)placement of a urinary urethral ( $n = 61$ ) or a suprapubic ( $n = 5$ ) catheter. Local wound infection occurred in 22 patients (4.6 percent). Diabetic patients (OR, 9.8;  $p = 0.003$ ; 95 percent CI, 2.8 to 34.4), patients who used anticoagulants (OR, 5.8;  $p = 0.027$ ; 95 percent CI, 1.5 to 22.3), and patients with a history of drug use had a higher risk of local infection. Urinary tract infections occurred in 21 patients (4.4 percent), which could all be managed successfully with oral antibiotics. Patients with comorbid hypertension (OR, 3.7;  $p = 0.024$ ; 95 percent CI, 1.3 to 10.8) or cardiovascular disease (OR, 3.9;  $p = 0.009$ ; 95 percent CI, 1.5 to 10.0) or who used anticoagulants (OR, 6.1;  $p = 0.024$ ; 95 percent CI, 1.6 to 23.7) had a higher risk of urinary infection. Patients with comorbid psychiatric disease and use of psychotropic medication had a higher chance of urinary retention

**Table 2. Intraoperative and Postoperative Complications**

	Total (%)	Penile Inversion (%)	Penile Inversion plus FTG (%)
No.	475	405	70
Intraoperative complications			
Rectal injury	11 (2.3)	10 (2.5)	1 (1.4)
Urethral injury	5 (1.1)	5 (1.2)	—
Short-term postoperative complications			
Infection			
Expectant	1 (0.2)	1 (0.2)	—
Antibiotics	19 (4.0)	18 (4.4)	1 (1.4)
Incision and drainage	2 (0.4)	2 (0.5)	—
Incision, drainage, and antibiotics	1 (0.2)	1 (0.2)	—
Bleeding			
Hematoma, expectant	16 (3.4)	15 (3.7)	1 (1.4)
Transfusion	23 (4.8)	22 (5.4)	1 (1.4)
Reoperation	7 (1.5)	5 (1.2)	2 (2.9)
Reoperation and transfusion	2 (0.4)	2 (0.5)	—
Necrosis			
Minor	117 (24.6)	101 (24.9)	16 (22.9)
Major*	3 (0.6)	3 (0.7)	0 (0)
Urinary			
Retention, CAD	61 (12.8)	51 (12.6)	10 (14.3)
Retention, SPC	5 (1.1)	5 (1.2)	—
Tract infection	21 (4.4)	20 (4.9)	1 (1.4)
Neovaginal prolapse			
After tampon removal	3 (0.6)	3 (0.7)	—
Fistula			
Rectoneovaginal	3 (0.6)	2 (0.5)	1 (1.1)
Long-term postoperative complications			
Stenosis			
Introital stenosis (introital plasty)	12 (2.5)	11 (2.7)	1 (1.4)
Neovaginal stenosis	15 (3.2)	11 (2.7)	4 (5.7)
Urinary			
Meatal stenosis	46 (9.7)	42 (10.4)	4 (5.7)
Splayed urinary stream	45 (9.5)	39 (9.6)	6 (8.6)
Fistula			
Urethroneovaginal	8 (1.7)	8 (2.0)	—
Prolapse			
Partial	18 (3.8)	15 (3.7)	3 (4.3)

FTG, full-thickness skin graft; CAD, coronary artery disease; SPC, suprapubic catheter.

\*Necrosis was defined as major if surgery under general anesthesia was necessary.

(OR, 2.1;  $p = 0.006$ ; 95 percent CI, 1.2 to 3.5), which occurred in 66 patients (13.9 percent).

Small wound dehiscence and minor wound necrosis for which no action was required occurred in 117 patients (24.6 percent). In three patients (0.6 percent), necrosis necessitated surgical débridement under general anesthesia. Neovaginal prolapse after tampon removal occurred in three patients (0.6 percent), which could all be addressed by repositioning of the penile inversion flap and tampon replacement for 5 days in combination with bedrest. Occurrence of short-term postoperative complications contributed to prolonged hospitalization ( $p < 0.001$ ). Hospitalization duration declined over the years, from a median of 8.5 days (range, 7 to 15 days) in 2000 to 6 days (range, 5 to 9 days) in 2014. (See Figure, Supplemental Digital Content 2, which shows median hospitalization length after penile inversion vaginoplasty over the years with interquartile ranges presented, <http://links.lww.com/PRS/B890>.) There was no intersurgeon variability with regard to intraoperative and postoperative complications.

### Long-Term Postoperative Complications

An overview of long-term postoperative complications is presented in Table 2. Revision vaginoplasty was performed in 14 patients (2.9 percent), all because of neovaginal stenosis. One patient with neovaginal stenosis refrained from undergoing revision vaginoplasty for unknown reasons. In 354 patients (74.5 percent), no reoperations were performed to enhance either neovaginal or urinary function.

The most common minor complications were related to the urinary tract. Meatal stenosis occurred in 46 patients (9.7 percent) after a median postoperative time of 4 months (range, 1 to 130 months). A splayed urinary stream occurred in 45 patients (9.5 percent) after a median postoperative time of 8 months (range, 3 to 151 months).

Meatal stenosis and a splayed urinary stream were primarily treated with meatotomy, possibly in combination with resection of the remains of the corpus spongiosum. Introital stenosis was observed in 12 patients (2.5 percent) after a median postoperative time of 0.5 years (range, 0.3 to 8.9 years). All were successfully treated by introital plasty by means of local transposition flaps. Partial prolapse occurred in 18 patients (3.8 percent). This usually comprised prolapse of the penoscrotal flap and could be easily corrected with minor surgery in all patients. Secondary cosmetic corrections were performed in 160 patients (33.7 percent), predominantly labia correction under local anesthesia.

### DISCUSSION

Penile inversion vaginoplasty is the surgical gold standard for vaginal reconstruction in transgender women.<sup>9,10</sup> We present the largest cohort study to date, examining intraoperative and postoperative complications. There were no significant differences in surgical outcome between penile-inversion vaginoplasty with or without the use of an additional full-thickness skin graft. The most frequently observed intraoperative complication was rectal injury [ $n = 11$  (2.3 percent)]. Bleeding noticed immediately postoperatively, which required transfusion, a reoperation, or both, occurred in approximately 6 percent of patients. The site of the bleeding, urethra, and remnants of the corpora are not specified and thus could not be distinguished. When examining the data, all but two transfusions were given before 2010. There were no major changes in operative technique, nor was it surgeon dependent. The reason for the high rate of blood transfusions before 2010 was not identified. Bleeding-related complications are reported to occur in 1.7 to 6.0 percent in the literature. Major long-term complications, with a median follow-up of 7.8 years, comprised three rectoneovaginal fistulas (0.6 percent), which were successfully treated. In our study, successful vaginal reconstruction was achieved in the vast majority of patients; only 14 patients (2.9 percent) needed revision vaginoplasty, all because of neovaginal stenosis.

An overview of the literature on intraoperative and postoperative complications of penile inversion vaginoplasty is presented in Table 3. Intraoperative complications during penile inversion vaginoplasty are scarce. We reported 11 cases (2.3 percent) of rectal injury and five cases of (1.1 percent) urethral injury. This is consistent with current literature, in which rectal injury is reported in 0.4 to 4.5 percent of patients.<sup>11-19</sup> Less is reported on the incidence of urethral injury. In a study of Rossi Neto et al., urethral injury occurred in 12 of 332 patients (3.6 percent).<sup>16</sup>

Meatal stenosis was observed in 46 patients (9.7 percent) in our study. The reported incidence of meatal stenosis after penile inversion vaginoplasty varies widely throughout the literature, from 1.1 to 39.8 percent.<sup>11-13,15-17</sup> At our institution, the transurethral catheter remains in place until the fifth postoperative day. In studies where meatal stenosis is more prevalent, the transurethral catheter is removed at an earlier stage, such as in the study by Rossi Neto et al., where the transurethral catheter is removed on the second postoperative day.<sup>16</sup>

**Table 3. Literature Review of Studies Assessing Intraoperative and Postoperative Complications after Penile Inversion Vaginoplasty**

	Perovic et al., 2000 <sup>11</sup>	Krege et al., 2001 <sup>12</sup>	Goddard et al., 2007 <sup>13*</sup>	Wagner et al., 2010 <sup>14</sup>	Reed et al., 2011 <sup>15</sup>	Rossi Neto et al., 2012 <sup>16</sup>	Raigosa et al., 2015 <sup>17</sup>	Sigurjonsson et al., 2015 <sup>18</sup>	Wangjiraniran et al., 2015 <sup>19</sup>
Patient number	89	66	233	50	250	332	60	205	395
Operative time, min									
Mean	NR	380	NR	190	180	NR	NR	197	180
Range	NR	240–540	NR	160–220	47–490	NR	NR	82–403	150–240
Hospitalization, days									
Median	NR	NR	10	10	NR	NR	NR	7	NR
Range	NR	NR	6–21	6–14	NR	NR	NR	5–33	NR
Intraoperative complications, %									
Rectal injury	1.1	4.5	0.4	—	2.8	3.3	1.7	—	—
Urethral injury	—	—	—	—	—	3.6	—	—	—
Postoperative complications, %									
Bleeding-related complications	—	—	3.2	6.0	2.4	3.3	1.7	10.7	3.0
Wound infection	—	9.1	16.8	—	—	—	—	9.8	4.0
Rectoneovaginal fistula	1.1	1.5	—	—	—	1.8	3.3	2.0	—
Urethroneovaginal fistula	—	1.5	—	—	0.8	3.9	—	—	—
Meatal stenosis	1.1	10.6	23	—	6.0	39.8	8.3	—	—
Splayed urinary stream	—	—	20	—	—	—	—	—	—
Introital stenosis	6.7	—	—	—	—	14.5	—	—	—
Neovaginal stenosis	2.2	4.5	6.1	—	1.2	12.0	3.3	—	—
Prolapse	—	3.0	1.8	—	2.4	1.2	—	—	0.3

NR, not reported.

\*Not all patients underwent vaginoplasty; some patients underwent penectomy, urethroplasty, and labiaplasty without opting for a skin-lined neovagina.

However, prolonged urinary catheterization may lead to a higher risk of catheter-related urinary tract infections.

Introital [ $n = 12$  (2.5 percent)] and vaginal [ $n = 15$  (3.2 percent)] stenosis were observed in our study, but not frequently. Both can impede the possibility of neovaginal penetration and adversely affect sexual quality of life. In the literature, the reported incidence of introital stenosis (6.7 to 14.5 percent) is higher.<sup>11–19,15–18</sup> This difference could be attributable to postoperative dilation frequency or the use of the perineoscrotal flap, none of which can be corroborated in the literature. At our institution, patients are advised to dilate twice daily for 30 minutes to minimize the chance of developing introital and/or vaginal stenosis. If introital stenosis occurs, self-dilation with the help of a pelvic floor physiotherapist is the treatment of choice.

In our study, comorbid diabetes was associated with a higher risk of local infection after penile-inversion vaginoplasty. For many types of surgery, this has been shown to be the case.<sup>20</sup> Presumably, wound healing is delayed by an altered inflammatory response, because of hyaline arteriolosclerosis and impaired leukocyte function caused by high glucose levels. Strict preoperative and

postoperative glucose regulation may lower the rate of postoperative local infections.<sup>21</sup> Patients with comorbid psychiatric disease and use of psychotropic medication had a higher risk of postoperative urinary retention. The anticholinergic effect of psychotropic drugs possibly plays a role in this process.<sup>22</sup> No association was found between body weight and postoperative complications, but most patients had a body mass index less than 30 kg/m<sup>2</sup>. In general, more of infections and wound healing problems are reported in overweight patients.<sup>23</sup>

A strength of our study is the high case volume reported on. A weakness of our study is that patients with complications may have presented at other (international) institutions, which may influence long-term follow-up data. However, our institution is the only institution in The Netherlands that offers all facets of transgender health care. Therefore, it is unlikely that they have consulted other centers in our country, without consultation of one of our surgeons.

## CONCLUSIONS

After reviewing 475 penile inversion vaginoplasty procedures performed over the past 14 years,

we conclude that successful vaginal construction is achieved in the majority of patients without the need for a secondary functional reoperation. Intraoperative complications are scarce. The prevalence of postoperative complications is high, but most are minor and can be easily treated.

**Marlon E. Buncamper, M.D., Ph.D.**

Department of Plastic, Reconstructive, and Hand Surgery  
VU University Medical Center  
De Boelelaan 1117  
1081HV Amsterdam, The Netherlands  
m.buncamper@vumc.nl

#### REFERENCES

1. Coleman E, Bockting W, Botzer M, et al. Standards of Care for the Health of Transsexual, Transgender, and Gender-Nonconforming People, Version 7. *Int J Transgend.* 2012;13:165–232.
2. De Cuypere G, T'Sjoen G, Beerten R, et al. Sexual and physical health after sex reassignment surgery. *Arch Sex Behav.* 2005;34:679–690.
3. Weyers S, Elaut E, De Sutter P, et al. Long-term assessment of the physical, mental, and sexual health among transsexual women. *J Sex Med.* 2009;6:752–760.
4. Ainsworth TA, Spiegel JH. Quality of life of individuals with and without facial feminization surgery or gender reassignment surgery. *Qual Life Res.* 2010;19:1019–1024.
5. de Vries AL, McGuire JK, Steensma TD, Wagenaar EC, Doreleijers TA, Cohen-Kettenis PT. Young adult psychological outcome after puberty suppression and gender reassignment. *Pediatrics* 2014;134:696–704.
6. Rolle L, Ceruti C, Timpano A, Falcone M, Frea B. Quality of life after sexual reassignment surgery. In: Trombetta C, Liguori G, Bertolotto M, eds. *Management of Gender Dysphoria: A Multidisciplinary Approach.* New York: Springer; 2015:193–199.
7. Karim RB, Hage JJ, Bouman FG, de Ruyter R, van Kesteren PJ. Refinements of pre-, intra-, and postoperative care to prevent complications of vaginoplasty in male transsexuals. *Ann Plast Surg.* 1995;35:279–284.
8. Buncamper ME, Honselaar JS, Bouman MB, Özer M, Kreukels BP, Mullender MG. Aesthetic and functional outcomes of neovaginoplasty using penile skin in male-to-female transsexuals. *J Sex Med.* 2015;12:1626–1634.
9. Horbach SE, Bouman MB, Smit JM, Özer M, Buncamper ME, Mullender MG. Outcome of vaginoplasty in male-to-female transsexuals: A systematic review of surgical techniques. *J Sex Med.* 2015;12:1499–1512.
10. Bizic M, Kojovic V, Duisin D, et al. An overview of neovaginal reconstruction options in male to female transsexuals. *ScientificWorldJournal* 2014;2014:638919.
11. Perovic SV, Stanojevic DS, Djordjevic ML. Vaginoplasty in male transsexuals using penile skin and a urethral flap. *BJU Int.* 2000;86:843–850.
12. Kregel S, Bex A, Lümmen G, Rübben H. Male-to-female transsexualism: A technique, results and long-term follow-up in 66 patients. *BJU Int.* 2001;88:396–402.
13. Goddard JC, Vickery RM, Qureshi A, Summerton DJ, Khoosal D, Terry TR. Feminizing genitoplasty in adult transsexuals: Early and long-term surgical results. *BJU Int.* 2007;100:607–613.
14. Wagner S, Greco F, Hoda MR, et al. Male-to-female transsexualism: Technique, results and 3-year follow-up in 50 patients. *Urol Int.* 2010;84:330–333.
15. Reed HM. Aesthetic and functional male to female genital and perineal surgery: Feminizing vaginoplasty. *Semin Plast Surg.* 2011;25:163–174.
16. Rossi Neto R, Hintz F, Kregel S, Rubben H, Vom Dorp F. Gender reassignment surgery: A 13 year review of surgical outcomes. *Int Braz J Urol.* 2012;38:97–107.
17. Raigosa M, Avedimento S, Yoon TS, Cruz-Gimeno J, Rodriguez G, Fontdevila J. Male-to-female genital reassignment surgery: A retrospective review of surgical technique and complications in 60 patients. *J Sex Med.* 2015;12:1837–1845.
18. Sigurjonsson H, Rinder J, Möllermark C, Farnebo F, Lundgren TK. Male to female gender reassignment surgery: Surgical outcomes of consecutive patients during 14 years. *JPRAS Open* 2015;6:69–73.
19. Wangjiraniran B, Selvaggi G, Chokrungvaranont P, Jindarak S, Khobunsongserm S, Tiewtranon P. Male-to-female vaginoplasty: Preecha's surgical technique. *J Plast Surg Hand Surg.* 2015;49:153–159.
20. Zhang Y, Zheng QJ, Wang S, et al. Diabetes mellitus is associated with increased risk of surgical site infections: A meta-analysis of prospective cohort studies. *Am J Infect Control* 2015;43:810–815.
21. Al-Niaimi AN, Ahmed M, Burish N, et al. Intensive postoperative glucose control reduces the surgical site infection rates in gynecologic oncology patients. *Gynecol Oncol.* 2015;136:71–76.
22. Tammela T, Kontturi M, Lukkarinen O. Postoperative urinary retention: I. Incidence and predisposing factors. *Scand J Urol Nephrol.* 1986;20:197–201.
23. Waisbren E, Rosen H, Bader AM, Lipsitz SR, Rogers SO Jr, Eriksson E. Percent body fat and prediction of surgical site infection. *J Am Coll Surg.* 2010;210:381–389.